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- (56) References cited; EP-A- 0 788 920 US-A- 5 508 122

UB-A- 5 350 684

- PATENT ABSTRACTO OF JAPAN vol. 017, no. 683 (E-1477), 15 December 1993 & JP 05 234820 A (SONY CORP), 10 September 1993
- PATENT ABSTRACTS OF JAPAN vol. 012, no. 158 (E-608), 13 May 1988 & JP 62 272471 A (TOSHIBA CORP), 26 November 1987

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# Description

# BACKGROUND OF THE INVENTION

#### 5 Flaid of the invention

[9001] The present invention retains to a nonequous-electrolyte secondary battery incorporating a coll electrode formed by lambitating elongated positive and negative electrodes through separators such that the outermost layer is the positive electrode.

# Related Background Art

[0002] Hitherto, secondary betteries for electronic apparatuses have been nicklel-cadmium betteries or lead betteries. The progress of the electronic technique made in recent years has calcade the performence of the electronic apparatus to be improved, the size to be reduced and a portable structure to be realized. As a result, a requirement has arisen to raise this energy density of the electronic apparatus. However, there arises a problem in that the energy density of the electronic made that the energy density of the electronic made because of low discharge voltages.

[8003] In recent years, a nonaquinous-electrolyte secondary battery has energetically bean developed and recearched as a secondary highery expected to be capable of rateing the discharge voltage and realizing small selfdischarge and a long Bettine against cycle operations. The nonaqueous-electrolyte secondary battery has been employed in piece of the hickel-cadmium battery and the lead bettiry. The nonegalous-electrolyte secondary battery incorporates a negative electrode made of a material, such as earlier material, which permits deping/dedoping/lithium long; and a positive electrode made of a composite lithium code, such as composite lithium-code) code.

[8004] As described above, the nonaqueous-electrolyte secondary bettery to required to have satisfactory chargoterfettos including a discribege characteristic under a neavy load and filtatine against a cycle operation. Therefore, the
structure of the electrodes of the above-mentioned nonaqueous-electrolyte secondary hallow has usually been formed
bructure of the electrode of the above-mentioned nonaqueous-electrolyte secondary hallow has usually been formed
by applying a positive-electrode mix layers 102s and 102b formed by applying a positive-electrode into the two sides of
a collector 101. An elongated negative electrode 108 straightly incorporates negative-electrode-mix layers 105s and
105b formed by applying a negative-electrode with to each of the two sides of a collector 104. The positive and negative
electrodes 103 and 106 are webted such that a separator 107 is interposed so that a coll electrode 108 is formed, in
the foregoing cities, internel short circuit occurring when Eintern is deposited during a charging operation must be prevented. Therefore, the width and length of the negative electrode 108 opposite to the positive electrode 109 usually
are must to be larger than those of the positive electrode 108 opposite to the positive electrode 109 usually

[8005] The above-mentioned coil electrode 108 incorporation the magnifive electrode 108 which forms the immemost layer and the outermost layer. Therefore, portions, each containing non-reacted negative-electrode active material which does not concien the charge/discharge, exist edjacant to the end of the outermost layer of the negative electrode 108 and the impermost layer of the same. Therefore, the inside portion of the battery cannot effectively be used. As a result, there exists a problem in that the energy density connot satisfactorily be relead.

[0006] To solve the above-mentioned problems, a technique has been decided in Japanese Patent Laid-Open No. 5-234820. As shown in FIG. 2, an elongated positive electrode 113 incorporates positive-electrode-mix isyers 112s and 112b formed by applying a positive-electrode mix to each of the two sides of a collector 111. An elongated negative electrode 116 incorporates negative-electrode mix to each of the two sides of a collector 114. The positive electrode 115 and the negative electrode 115 are wound such that a separator 117 is interpreted so that a coll electrode 115 is formed. The outermost typer electrode, with which charge/discharge of the coll electrode 118 is performed, is made to be the positive electrode 113. Moreover, a portion edjacent to an outermost end 113b is formed such that the positive-electrode-mix byer 112a (only the inner positive-electrode-mix byer 112a in the foregoing case) is formed on only either mate arrives of the collector 111. Thus, the quantity of the non-reacted negative-electrode active material in the bettery can be reduced. Thus, the inside portion of the bettery is effectively used to raise the energy density correspondingly.

[0007] However, the above-mentioned coil efactrode has the structure as shown in FiG. 2 such that the outermost and 116s of the negative electrode 148 is formed by only the collector 114. A negative-stactrode lead 119 is provided for the upper surface of the collector 114 sp that a projection is fermed on the upper surface. Also the positive electrode 113 has an outermost and 113a formed by only the collector 111. If the projection exists as described above, the projection pierces the separator 117 disposed between the negative electrode 118 and the positive electrode 113. Thus, the projection is undestrably brought into contact with the collector 111 of the positive electrode 113. It leads to

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a fact that short circuit deelly teless place. As a result, a percent defective to raised and, therefore, reliability deteriorates.

# SUMMARY OF THE INVENTION

[0063] In view of the foregoing, an object of the present invention is to provide a nonequeous-electrolyte secondary bettery which reduce the quantity of a non-reacted active material for the negative electrode in the bettery to effectively use the inside pointion of the battery so as to raise the energy density, elongate the lifetime against a cycle operation, prevent a defact and improve the reliability.

[tions] According to criss aspect of the present invention, there is provided a nonaqueous-electrolyte secondary baltery including: a cell electrode formed by tahinating on elengated positive electrode which has a positive-electrode
mix layer formed on all east either of main surfaces of a positive-electrode collector and an elengated regative electrode
which has in negative-electrode-into tayer formed on at least either main surfaces of a negative-electrode collector and
by wholing if formidd is minister such that the positive electrode is positive at the cutamost positive electrode,
wherein the positive-electrode-into tayer is formed on only other of main surfaces of the collector at the positive electrode,
the positive-electrode-into tayer is formed on the positive-electrode collector at the positive electrode,
the positive-electrode-into tayer is not formed on the positive-electrode collector at the outermost end of the positive
electrode and only the positive-electrode collector is formed, if o negative-electrode and only the negative-electrode collector
is formed, and the outermost end of the negative-electrode collector positive outer portion of the coll electrode
electrode is, in the direction from the inner portion of the fool electrode collector;

[0010] The notisqueous-electrolyte secondary bettery according to the present invention may have a structure that the cult electrode incorporates a negative-electrode lead adjacent to an outermost end of the negative-electrode collector positioned at the outermost end of the negative-electrode, and the negative-electrode lead is positive-electrode than the outermost end of the positive-electrode collector positioned at the outermost end of the positive-electrode.

[0011] The nonequiecus-electrolyte secondary bettery according to the present invention may have a structure that the coll electrode has a structure that distance L from the cutomost and of the negative-electrode collector positioned at the outermost end of the negative-electrode collector positioned at the outermost end of the positive electrode to the distrimunit end of the positive electrode which are positioned in a fore-end-aft direction from the inner portion of the coll electrode toward the outer portion of the coll electrode catteriors the following relationship on an assumption that the dismeter of the coll electrode is d:

# 0< L ≤ πd

[0012] The nonequance-electrolyte secondary battery according to the present invention may have a structure that the negative-electrode mix contains a negative-electrode material and a binder.

[0013] The nonequeous-electrolyte accordary bettery according to the present invention may have a structure that the negative-electrode material is at least one type material selected from a group consisting of a crystalline metal oxide and an emorphous material oxide which permit deping/dedoping limburn lone.

[9014] The nonequeous-electrolyte secondary bettery according to the present invention may have a structure that the positive-electrode mix contains a positive-electrode material, a conductive material and a binder.

[00,16] The nonequeous-electrolyte secondary bettery according to the present invention may have a structure that the positive-electrody material is at least one type material selected from a group consisting of LiuC<sub>2</sub> (where M is at least any one of Co, M, Mn, Fa, Al, V and TI) and interlayer compounds each containing LL.

[00,16] The nonequeous-electrolyte secondary bettery according to the present invention may have a structure that

the separator is made of at least one type material selected from a group consisting of polyathylene and polypropylane.

[0917] The nonaquiscus-electrolyte secondary battery according to the present invention may have a structure that
the positive-electrodic collector is made of at least one type material selected from a group consisting of eluminum,
stainlines also and nickel.

[8018] The remagnature electrolyte according battery according to the present invention may have a structure that the negative-electrode collector to made of at least one type material selected from a group constains of copper, staintsee steel and nicket.

for [0019] The nonaiguacus-electrolyte secondary battery according to the present invention may have a structure that the nonaiguacus-electrolyte secondary battery contains a nonaiguacus electrolyte prepared by dissolving an electrolyte in nonaiguacus solvent, and the nonaiguacus solvent is made of at least one type material selected from a group consisting of propytene corbonate, elliptene carbonate, 1, 2-dimethoxyethere, 1, 2-disthoxyethere, disthytearbonate,

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y-butyrotectore, tetrahydrofuran, 1,3-dioxotene, 4-methyl-1, 3-dioxotene, diethylather, suffolene, methylsuffolene, acetonitrile and propionitrile.

[0029] The nonequeous-electrolyte secondary battery according to the present invention may have a structure that the electrolyte is at least one type material selected from a group consisting of LICIOs, LIASEs, LIPEs, LIBEs, LIBICSHE). LICI, LIEF, LESO, CH, and LESO, CF,

[0021] Other objects, toelunes and advantages of the Invention will be evident from the following detailed description of the preferred embodiments described in conjunction with the attached drawings.

# BRIEF DESCRIPTION OF THE DRAWINGS

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FIG. 1 is a order actional view showing the structure of a conventional nonequeous-electrolyte accondary battery; FIG. 2 is a cross sectional view showing enotion conventional nonaqueous-electrolyte accordary bettary,

FIG. 3 is a cross sectional view showing the structure of a nunequeous-electrolyte secondary bettery according to the present invention;

FIG. 4 is a crose sectional view showing the abrecture of the nonaqueous-electrolyte secondary testiony according to the present invention:

FIG. 5 is a poispective view showing a portion including a positive-electrode collector of the nonaqueous-electrolyte secondary battery according to the present invention.

# DESCRIPTION OF THE PREFERRED EMBODIMENTS

[8923] An embodiment of the present invention will now be described with reference to the drawings.

[0024] An embodiment of a manageous-electrolyte secondary battery according to the present invention is shown h FIG. 3.

[P025] The nonaqueous-electrolyte secondary battery according to this embodiment, as shown in FiG. 3, incorporates a positive electrode 3 having positive-electrode-mix layers 2a and 2b formed on the two sides of a positiveelectrode collector 1. Moreover, a negative electrode 8 tricorporates negative-electrode-mb: layers Se and Sb formed on the two sides of the negative-electrode collector 4. The positive electrode 3 and the negative electrode 6 are wound such that a separator 7 is interposed. The separator 7 is a small-pore film made of polypropylene or polysthylens. Thus, a coll electrode is formed. Thus, insulating members 8 are placed on the two vertical surfaces of the coll electrode. followed by accommodating the coil electrodic having the traulating members 0 into a battery can 9.

[D026] A bettery cover 10 is juined to the bettery can 9 by extending the battery cover 10 through a scaling greatest 11. The battery dower 10 and the bottory can 9 are electrically connected to the positive electrode 3 and the negative electrode 8 respectively through a positive-electrode lead 12 and a negative-electrode lead 13. Thus, the positive electrode and the pagative electrode of the buildry are formed.

[0027] Note that a current-limiting thin plate 14 serving as a safety unit is provided for the battery according to this embodiment. The positive-clockrode lead 12 is welded to the current-limiting thin plate 14 so as to electrically be connected to the bettery cover 10 through the current-limiting thin plate 14.

[0028] When the presidre in the battery having the above-mentioned structure has been raised, the current-limiting thin plate 14 is pushed upwards and therefore deformed. Thus, this positive-electrods lead 12 is can such that a portion welded to the current-limiting thin plate 14 is left. As a result, the electric current is limited,

[8929] A cross sectional structure of the honoqueous-electrolyte securicary buttery according to the present invention is shown in FIG. 4. In the nonequeous-electrolyte accondary ballary according to this embodiment, the positive-electrade-mix layer 2a is, as shown in FIG. 4, formed on only either main surface (on the inside) of the positive-electrode collector 1 at a position signment to an outsimple and 3a of the positive electrods 3 and/or an innermost and 3b of the same. No positive electrode-mix layer is formed on the positive-electrode collector 1 at the outsmoot end 3e of the positive electrode 3. Moreover, no negative-electrode-mix izyer is formed on the negative-electrode collector 4 at an outermust end 6s of the regative electrode 6. Thist is, only the regative-electrode collector 4 is formed at the outermost end Bo.

[0030] In a direction from this inner portion of the coll electrode 15 to the outer portion of the same, an outermost and of the negative-electrode collector 4, which is the outcorrect and the negative electrods E, is positioned more forwards than the outermost and of the positive-electrode collector 1 which is the outermost and 3s of the positive electroda 3.

(0031) As described above, the positive-electrode-mix layer 2s is formed on only either main surface of the positiveelectrode collector 1 at the position adjacent to the outermost and Sa of the positive electrode 3 and/or the position adjacent to the innormost end 3b of the same. Therefore, the necessity of applying the positive-electrode mix to each

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of the two sides of the positive-electrode collector 1 can be eliminated. Therefore, a portion to which the positive-electrode-collector 2 is applied must be formed on the main surface of the positive-electrode collector 1, as shown in Fig. 5.

[0032] In the noraqueous-electrolyte secondary ballary eccording to the present invantion, the negative-electrode lead 13 is formed edjacent to the outernost and of the regative-electrode collector 4 which is the outermost and 8s of the negative-electrode 3 of the coll electrode 15. In a direction from the inner portion of the coll electrode 15 to the outer portion, the negative-electrode lead 13 is positived more forwards than the outermost end of the positive-electrode collector 1 which is the outermost and 3s of the positive electrode 3. Note that the nonaqueous-electrolyte secondary ballary eccording to the present invention has a structure that a positive electrode lead (not shown) of the positive electrode 3 to disposed in the inkide piction.

[0033] An assumption will now be described which is made about the following distance of a region in the coll electrode 16 of the nonequeous-electrolyte secondary battery seconding to the present invention. The distance is a distance in the tenglishmal direction from the lunar-portion of the coll electrode 16 toward the outer portion of the same. The assumption is made that the distance from the outermost end of the registive-electrode collector 4, which is the outermost end 6a of the negative electrode 6, to the outermost end of the positive-electrode collector 1, which is the outermost end 3a of the positive electrode 3, is t. Another assumption is made that the dismeter of the coll electrode 15 to d. It is preferable that the relationship 0 < t.s. ad is estimated.

[0034] The nonaquicous-electrolyte secondary bettery according to the pretent invention incorporates the cell electrode 15. The cell electrode 15 is formed by laminating the elegatest positive electrode 3 and the elegated negative electrode 6 which are tentificated through the separator 7 such that the outermost layer is the positive electrode 3. The positive electrode-mix layer 2a is formed on only either main surface of the positive-electrode collector 1 at the positive adjacent to the instrument and 3e of the positive electrode 3 and/or the positive electrode collector 1 at the outermost and 3e of the positive electrode collector 1 at the outermost and 3e. Moreover, no negative-electrode collector 4 at the outermost and 3e. Moreover, no negative-electrode collector 4 at the outermost and 6e of the negative electrode 6. Only the negative-electrode collector 4 is formed at the outermost and 6e of the negative electrode 6. Only the

[0935] In the direction from the inner particle of the coll electrode 15 toward the outer particle, the outermost and of the negative-electrode collector 4, which is the outermost and 6s of the negative-electrode 5. In positioned more forwards than the outermost and of the positive-electrode active material in the bettery can be reduced. As a result, on effective area can be enterined correspondingly in the bettery. Thus, the inside particle particl

[0037] In the coll electroide 15 of the nonequeous-electrolyte secondary bettery according to the present invantion, the observation of the negative-electroide collector 4, which is the observation and 6s of the negative-electroide collector 1, which is the observation and 6s of the positive electroide 3, and positioned in the fore-end-off direction from the inner parties of the observation 15 toward the observation of the same. An essumption is made that the distincts from the observation and of the positive-electroide collector 1 to L. Another examplion is made that the dismaster of the coll electroide 15 is d. In this case, it is preferable that the responsible 0 < L ≤ ad is satisfied. If the foregoing structure is employed, no informal short circuit occurs, the energy density is furthermore related and the lifetime against a cycle operation can furthermore be elemented.

[0038] A state will now be considered that the distance L from the outermost end of the regulive electrode collector 4, which is the outermost and de of the regative electrode 6, to the outermost and of the positive-electrode collector 1, which is the outermost and 3s of the positive electrode 3, to shorter then the above-mentioned range. In the furegoing case, the outermost end of the positive-electrode collector 1 overlaps the outermost and of the regative-electrode collector 4.

[0039] Therefore, the percent defective is related though the energy density is not lowered. If the distance L is longer than the above-mentioned range, many portions are produced in which the negative electrode 6 and the positive electrode 3 are not opposite to each other. Therefore, the energy density is undestrainly lowered though the percentage defective is not lowered.

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(0040) The positive electrode 3 and the negative electrode 6 according to the present invention have the above-mentioned structures. The mix layers and collectors for constituting the positive electrode 3 and the negative electrode 6 may be known materials.

[0041] The positive-electrode-mix toyone 2a and 2b confain a positive-electrode material, which permits lithium lons to be doped/dedoped, a conductive material and a binder.

10442] If the professible that the positive-electrode material contains Li in a sufficiently large quantity. For exemple, it is professible that to employ a composite metal codds expressed by LRHO<sub>2</sub> (where M is at least one type of a material selected from a group consisting of Co, Ni, Mn, Fe, Al, V and Ti) and composed of Li and a transition metal; or an interloyer compound containing LL.

[0043] The conductive material for importing conductivity to the positive electrode and the binder for causing the positive-electrode material to be held by the positive-electrode collector may be known materials.

[8844] The conductive medicial may be graphite or certion black, while the binder may be fluorine resin, such as polyvinytidens fluoride.

[0045] The negative-electrode-mix layers 5a and 5b contain the negative-electrode material which permits inhim, loss to be depended and a binder.

[9046] The negative-electrode material may be a cortion regional. The carbon material is examplified by pyrocerbon, color (plich color, needle color and patrolaum toke), graphite, vibracus carbon, a calcinated organic polymer compound (a meterial obtained by calcinating phenot resh, furan resh or the flor), carbon ther and active carbon. The negative-electrode material may be crystalline metal code or amorphous metal code which permits lithum ions to be depart decoped, as wall as the targeting carbon material.

[0047] The blaster for exceeding the negative-electrode mixtures to be held by the negative-electrode collector may be a known material. For example, the blaster may be sucrine rectin, such as polyvinylidene sucride.

[0048] The battery eccording to the present invention contains a known nonaqueous electrolyte in which an electrolyte is dissiblyed in nonaqueous advent, such as organic solvent.

[0949] The organic solvent is not limited particularly. The organic solvent is assimplified by propytene carbonate, ethylene carbonate, 1, 2-dimethoxyethene, 1, 2-distance the carbonate, 1, 2-dimethoxyethene, 1, 2-distance thene, tetrahydrofurer, 1,3-discolarie, 4-methyl-1, 3-discolarie, distription, sufficience, methylauficience, acctoratelle and proporatifie. Any one of the taregoing material may be employed or a mixture of the same may be employed as arbed solvent.

[0050] The electrolyte is not limited particularly. The electrolyte is examplified by LICIQ<sub>4</sub>, LIA<sub>E</sub>F<sub>6</sub>, LIBF<sub>4</sub>, LIB (C<sub>2</sub>H<sub>2</sub>)<sub>4</sub>, LICI, LIBC<sub>3</sub>CH<sub>3</sub> and LISO<sub>3</sub>CH<sub>3</sub>.

[0051] The material of the expersion 7 is not finited paintouterly. The material is exemplified by woven fabric, unwoven fabric or small-point film made of synthetic reain. In particular, the small-point film made of synthetic reain is a preferred material. Moreover, a polyoletine small-point film is a preferred material in viewpoints of realizing a required thickness, strength of the formed film and resistance of the film. Specifically, the following materials may be employed: a small-point film made of polyotypic or a small-point film made of polyotypic properties.

[0052]. The shape of the collector of the electrode is not finited particularly. A foil structure, a much structure or a not structure made of expand motal may be employed; it is preferable that the positive-electrode collector 1 is made of, for example, sharifrom, stabiless start or nickel, it is preferable that the negative-electrode collector 4 is made of, for example, copper, stainless steel or nickel.

[0053] The bittlery can 9 may be made of iron, nickel, stainless steel or eluminum. If electrochemical corresion occurs in the nonaqueous electrolyte containing the above-mentioned meterial during the operation of the battery, platting may be performed.

# 5 Examples

[0054] Examples of the present invention will now be described with results of experiments.

Manufacturing of Sumples-

# Sample 1

[0955] hitfolly, the negative electrode was manufactured as follows.

[0056] Protoloum pitch was employed as a starting material, followed by calcinating the petroleum pitch so that coarse pitch coke was obtained. The coarse pitch coke was privated so that powder having an average particle size of 40 µm was obtained. Then, the obtained powder was calcinated in an inactive gas at 1000°C to remove impurities. Thus, coke powder was obtained.

[5057] Then, 90 parts by weight of thus-obtained color powder, serving as a carrier for negative-electrode active

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material, and 10 parts by weight of polyvinylidene fluoride (PVDF) serving as a binder were mixed. Thus, a negativeelectrode mix was prepared, followed by dispersing the negative-electrode mix in N-methylpyrolidone which serves as solvent. As a regult, negative-electrode mix shary was obtained. The negative-electrode mix stary was applied to the two sides of a negative-electrode collector in the form of copper foil having a thickness of 10 µm. Then, the applied solvent was dried. The negative-electrode collector was compression-moded with a roller pressing machine. As a result, an elongated negative electrode was obtained which had a width of 41.6 mm and a langth of 250 mm. The thickness of the negative-electrode-mix layer on each side of the negative-electrode collector was 105 µm. The negative-electrode-mix layer was not formed on the negative-electrode collector of the negative electrode at the outermost end. A partian farmed by anly the negative-electrode collector was created.

[0056] On the other hand, the positive electrode was manufactured as follows.

[0058] That is, 0.05 male of Ethian carbonate and 1 mole of coboli curbonate were mixed with each other, and then the mix was catcheded at 900°C in air for 5 hours. Thus, LtCoO<sub>2</sub> was obtained.

[0080] Then, obtained LICoO<sub>2</sub> were used so a positive-electrode active material such that 91 parts by weight of LICoO<sub>20</sub> 5 parts by weight of graphite serving as a conductive material and 3 parts by weight of polyvinylitions fluoride (PVDF) serving as a binder were indeed with each other. Thus, a positive-electrode mix was prepared. Then, the obfalmed positive-electrode mix was dispersed in N-main/pyrolidone so that positive-electrode mix starry was obtained. The positive-electrode mix sturry was applied to a region of only either side of a positive-electrode collector made of elongated altitutnium fall having a thickness of 20 µm, the region having a length of 247 mm. Then, the positive-alectrode mix sturry was dried. Then, positive-electrode mir siurry was applied to the other main surface of the positive-electrode collector in a region having a length of 167 mm such that a position at which the application was started were made colocide with the above-mariticized positive-electrods mix storry. Then, the positive-electrode mix storry was dried, followed by compressing the two sides of the positive-electrode collector with a roll to compression-moid the positiveelectrode collector. Thus, an elongstaid positive electrode was obtained which had a width of 38.5 mm. The positive electrode incorporated a portion having two sides on each of which the positive-electrode-mix layer was formed, the portion having a length of 167 mm. A portion of the positive electrode, on either side of which the positive-electrodemb; layer was formed, had a kingth of 60 mm. The thickness of each of the positive-electrode-mit; layers was 80 µm. The positive electrode had the outsimest end and the innermost and each incorporating a portion in which the positive-

[0081] The thus-manufactured elongisted positive electrode and the negative electrode and two separators, seach of which had a thickness of 25 pm and a width of 44 mm and which were in the form of small-pore polypropytene films. were laminated. The luminate had four layers formed by sequentially luminating the negative electrode, the separator, the positive electrods and the separator in this sequential order. The laminate was langitivise wound plural times. Thus, a spiral shape was formed which had a structure first the portion in which only either side of the positive-electrode collector had the positive-electrods-mix layer was that wound and the negative electrode was placed inside. The end of the outermost separator was secured with a tape. Thus, a coll electrode was manufactured. The negative electrode of the coll electrode was longer than the positive electrode of the same. Therefore, in the direction from the inner portion of the coll electrode toward this outer portion, the outermost and of the negative electrode collector which was the outermost end of the negative electrode was, as a matter of course, positioned more forwards then the outermost end of the positive electrode collector which was the outamost end of the positive electrode,

electrode-mix layer was not formed and in which only the positive electrods collector was formed.

[0.062] The cuter diameter of the coll collector was 13 mm, while the inner diameter of a hollow portion formed in the central portion of the coll collector was 3.5 mm. The outermost and of the negative-electrode collector which was the outermost end of the negative electrods and the outermost end of the positive-electrode collector which was the outarmost and of the positive electrode were positioned spart from each other in the fore-end-aft direction for distance L

which was 35 mm.

[0063] In this embodiment, the negative-electrode lead was positioned at the outermost end of the negative electrode, while the puelike-electrods lead was positioned at the immermost end of the positive electrode.

[0094] The true-manufactured cell electrode was accommodated in an fron bettery can applied with nickel plating. An insulating plate was placed on each of the upper and lower sides of the coll electrode. The positive electrode lead was connected to the battery cover by welding, while the negative-electrode lead was connected to the battery can by

Then, a nonequeous electrolyte was prepared by dissolving, at a concentration of 1 molecules, LIPF $_{\rm S}$  in a shed solvent which contained propytene cerbonate and distryl cerbonate in the same quantities. Then, 3.0 g of the nonaqueous electrolyte was injected into the buttery can so as to be impregnated into the coil electrode. Then, the battery can wee crimpaid through an insulating sealing gaskel applied with asphelt so that the bettary cover was secured. Thus, the hermeticity in the battery was maintained.

[0086] Thus, a cylindrical nonequeous-electrolyte secondary bettery (heving a diameter of 14 mm and a height of 50 mm) was menutectured. The foregoing cylindrical nonequeous-stactfolyte secondary battery was called Sample 1 for convenience.

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# Semples 2, 3, 4 to 6, 11 and 12

[0057] Cylindrical nonaquiscus-electrolyte secondary betigries were manufacturing by a method similar to that for manufacturing Sample 1 accept for is structure in which the distance from the outermost and of the negative electrode to the outermost and of the positive electrode which was viried as shown in Table 1. The foregoing eccondary betisries were easied Samples 4 to 6, 11 and 12. To perform comparisons, cylindrical nonequeous-electrolyte secondary betisries were manufactured by a method shallow to that for manufacturing Sample 1, in this case, we shown in Table 1, the cylindrical nonequeous-electrolytersecondary betteries were different from Sample 1 as follows: the distance from the outermost end of the negative-electrode and the outermost end of the positive electrode was electrode to the positive-electrode collector in the autermost portion; the distance from the outermost end of the registive-electrode collector in the autermost portion; the end of the inspective-electrode collector concided with each other in the outermost portion. The foregoing comparative entiples were called Samples 2 and 3 for convenience. Samples 4 to 6, 11, 12, 2 and 3 were structured such that the outer damater of the cell electrode was made to be 13 mm by adjusting the lengths of the positive-electrode-mix layers formed on the two eldes of the negative electrode.

Table 1

28		Length of Positive-Electrode- Mix Layer Formed on Either Side of Positive Electrode at Innermost End	Length of Positive-Electrode- Mix Layer Formed on Either Side of Positive Electrode at Outermost End	Length of Positive-Electrode -Mix Layers Formed on Two Sides of Positive Electrode
20		of Positive Electrode (min)	of Positive Electrode (ann)	(mm)
18	Sample 1	80	0	167
15	Sample 2	80	0	· 167
	Sample 3	80	0	167
40	Sample 4	60	0	182
	Sample 5	40	0	197
48	Sample 6	20	0	201
***	Sample 7	0	5	205
	Sample 8	0	. 15.	. 202
<del>50</del>	Sample 9	0	50	176

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Sample 10	40	10	194
Sample 11	60	0	179
Sample 12	60	0	177
Sample 13	60	. 0	176
Sample 14	395	<u> </u>	0
Sample 15	395	_	0

20		Length of Negative-Electrode -Mix Layers Formed on Two Sides of Negative Electrode (mm)	Length of Negative-Electrode -Mix Layers Formed on Either Side of Negative Electrode (mm)	Distance from Outermost End of Negative Electrode to Outermost End of Positive Electrode (mm)
	Sample 1	250	0	35
30	Sample 2	250	0	-2
_	Sample 3	250	o	0
	Sample 4	245	0	15
35	Sample 5	240	0	10
	Sample 6	224	0	17
40	Sample 7	213	0	33
·	Sample 8	220	0	35
	Sample 9	229	0	50
48	Sample 10	247	0	5
L	Sample 11	243	0	27
80	Sample 12	241	0	38

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Sample 13	259	0	43
Sample 14	.0	398	35
Sample 15	0	398	0

	Energy Density Ratio (先)	Percent Defective (%)
. Sample 1	100.0	3
Sample 2	100.0	20
Sample 3	100.0	18
Sample 4	. 102.4	3
Sample 5	104.8	1 .
Sample 6	101.9	1 ,
Sample 7	100.2	2
Sample 8	101.2	2
Sample 9	97.1	.1 .
Sample 10	105.8	б
Sample 11	101.0	. 1
Sample 12	100.0	2
Sample 13	99.5	3
Sample 14	95.0	2
Sample 15	95.0	20

# Sample's 7 to 8

[9065] Processes similar to that for manufacturing Sample 1 were performed except for abuditives in which the positive electrode-risk layer was formed on only either side adjacent to the innormost end of the positive electrode. Moreover, the distincts from the outermost end of the negative electrode to the outermost end of the positive electrode was varied as shown in Table 1. Thus, cylindrical nonsequeue-electrolyte escondary betteries were manufactured. The thus-manufactured cylindrical nonsequeue-electrolyte escondary betteries were exited Samples 7 to 9 were structured such that the outer dismeter of the cold electrode was made to be 13 mm by adjusting the lengths of the positive-electrode-mix layers formed on the two sides of the positive-electrode and the lengths of the negative-electrode-mix layers formed on the two sides of the negative electrode.

# Semple 10

[0969] A cylindrical nonaquacus-electrolyte secondary bettery was manufactured by a method similar to that for

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manufacturing Sample 1 succept for structures in which the positive-electrode-mix layer was formed on only either side of positions adjusted to the inhermost and customost ends of the positive electrods. Moreover, the distance from the outermost end of the negative electrode to the outermost and of the positive electrode was varied as shown in Table 1. The thre-manufactured cylindrical nonequisous-electrolyte secondary bettery was called Sample 10 for convenience. Sample 10 Was structured such that the outer dismeter of the coll electrode was made to be 13 mm by adjusting the largins of the positive electrode-rule byers formed on the two sides of the positive electrods.

### Semple 14 and 15

[0076] Cylindrical nonequeous-sectrolyte secondary traiteries were manufactured by a method similar to that for transfacturing Sample 1 except for structures to which the positive electrods-into tayor was formed on the overeit length of only still for side of the positive electrode and the negative electrode. Moreover, the distance from the cutermost and of the negative electrode to the outermost and of the positive electrode was varied as shown in Table 1. The thusmanufactured cylindrical nonequeous-blockrolyte secondary batteries were called Samples 14 and 15 for conventence. Sample 14 and 15 were structured such that the outer diameter of the coll electrode was made to be 13 mm by adjusting the langths of the positive-electrode-main byers formed on the two sides of the positive electrode.

# Evaluation of Samples>

- [0071] Each of shriples 1 to 15 was charged for 8 hours at a charging voltage of 4,20 V with a charging ourrent of 300 mA, and then the foregoing sourples were, with a load of 600 mA, discharged to 2.75 V. Thus, the energy densities were mains0/ed. Assuming that the result of Sample 3 was 100, the energy densities of the eample betteries with respect to 100 were obtained. Also results were shown in Table 1, Moreover, a percentage defective of each bettery was obteined wild siso results were shown in Table 1.
- 25 % [0072] Comparisons were parformed by using results shown in Table 1 among Samples 2, 3 and 15 and samples 1, 4 to 14 activiting to the present invention. Samples 2, 3 and 15 were structured such that the distance from the outsimost end of the negative electrods to the outsimost end of the positive electrods was - 2 mm. Therefore, the positive-electricide collector overlapped the negative-electrode collector in the outermost portion. As an alternative to this, the distince from the outermost end of the negative electrode to the outermost and of the positive electrode was O mm. Therefore, the end of the negative-electrode collector and the end of this positive-electrode collector coincided with each citier in the outermost portion. Sumplee 1, 4 to 14 according to the present invention were manufactured such that the outsimisst and of the negative-electrode collector which was the outsimost and of the negative electrode was, in a direction from the liner portion of the coll electrode toward the cuter portion of the same; positioned more forwards then the outermost and of the positive-electrons collector which was the outermost and of the positive electrons trude. As a result of the comparisons, the samples according to the present invention enabled the percentage detective to considerably be reduced without reduction in the energy density.
  - [0373] Simples 1 and 4 to 14 according to the present invention were structured such that the outermost end of the nagrative electrode collector which was the outermost and of the negative electrode was, in a direction from the inner portion of the coR electricle toward the outsir portion of the same, positioned more forwards than the outsimost end of the positive electrode collector which was the outermost end of the positive electrode. Samples 1, 4 to 8 and 10 to 14 among the foregoing samples 1 and 4 to 14 were structured such that the distance L from the outermost and of the negative-attitions collector which was the outsimost and of the negative electrods to the outernost end of the positiveelectrode collector which was the outermost and of the positive electrode substied  $0 < L \le xd$  on an essumption that the diamater of the obliniectrode was d. Sample 9 did not satisfy the above-manifolded relationship. When the foregoing samples were compared with one another, Sample 9 encountered somewhat reduction in the energy density.
  - [0074] Saimples 14 and 15, having the electrode rate layer formed on only either side of each of the collectors of both of the positive electrode and the negative electrode, were stripleded to a comparison. When the electrode mix layer was formed on only either side of the collector, Sample 14 according to the present invention enabled the percentage defective to considerably be reduced without reduction in the energy density. On the other hand, Sample 15 to which the present invention to not applied encountered a high percentage detective.
  - [0075] As can be understood from the above-monitoned results, the structure of the present invention in which the alongaled positive and negative electrodes were laurented through separators, followed by winding a larranate such that the positive electrode forms the cutormost layer so that a cell electrode is formed. Moreover, the positive electrodethis layer is formed on only either main surface of the collector at a position adjacent to the outermost end of the positive electrode end/or a position adjacent to the innermost end. At the outermost and of the positive electrode; the positiveelectrode-mix tayer is not formed on the positive-electrode collector, that is, only the positive-electrode collector is formed. At the outermost and of the negative electrode, the negative-electrode collector is not formed on the negativeefections collector, this is, only the negative-electrode collector is formed. In the direction from the inner portion of the

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coll electrode toward the outer portion of the same, the outermost end of the negative-electrode collector, which is the outermost end of the negative electrode, is positioned more forwards then the outermost end of the positive-electrode collector which is the outermost end of the positive electrode. Thus, non-reacted active material for the registive electrode in the listing can be reduced. Thus, an effective area can be enlarged in the hattery correspondingly. Therefore, the helde portion of the battery can effectively be used, causing the energy density to be raised. Thus, elongation of the listing can effectively be used, causing the energy density to be raised. Thus, elongation of the listing can effectively be used.

(0076) In the present invention, the negative-electrode lead is formed adjacent to the exterment and of the negative-electrode collector which is the authorized and of the negative electrode. In the direction from the imper portion of the coll electrode invention of the same, the negative-electrode lead is positive-electrode. Thus, even if the negative-electrode is not the positive-electrode collector which is the outermost and of the positive-electrode. Thus, even if the negative-electrode lead pierces the separator disposed between the coll electrode and the bettery can, the negative-electrode is brought into contact with only the battery can which is the same negative-electrode. Therefore, internal short circuit does not take place and, therefore, any defect occurs. Thus, the reliability can be improved.

[0077] In the present invention, the outsimost end of the negative-electrode collector, which is the outsimost end of the negative electrode, and this outsimost end of the positive-electrode collector, which is the outsimost end of the positive-electrode collector, which is the outsimost end of the positive-electrode, are positioned fore-end-set in the distance from the inner portion of the positive-electrode toward the outsimost end of the negative-electrode collector to the outsimost end of the positive-electrode collector is i. and the distance of the coll electrode is d, the residenship 0 < i. S and is stilled. Thus, the energy density can furthermore be related and the lifetime against the cycle operation can furthermore be also existed.

[0078] This districtor of the cylindrical nonequeous-electrolyte secondary battery was varied to 18 mm and 20 mm to evaluate each of the manufactured cylindrical nonequeous-electrolyte secondary batteries. Thus, similar tendencies to those shown with the above-mentioned examples were shown.

(1979) An elliptical coil electrode was manufactured as the coil electrode so that a nonaqueous-electrolyte secondary battery which was a rectangular battery baving a thickness of 6 mm, a width of 34 mm and a height of 48 mm was manufactured so as to be evaluated. The automost end of the negative-electrode collector which was the outermost and of the positive-electrode collector which was the outermost and of the positive-electrode collector which was the outermost and of the positive-electrode collector positioned at the outermost and of the positive-electrode collector positioned at the outermost and of the positive electrode which were positioned fore-end-aff was not longer than the circumfatence. In this case, reduction of the persentage defective was enabled without reduction in the energy density.

[9989] As described above, the nonactive electrolyte according bathery according to the present invention incorporates: a coli electrode formed by leminsting an elongated positive electrode and an elongated registive electrode through a superintor and by whiting a formed laminate such that the positive electrode by positioned at the cultermost position, wherein the positive-electrode-mix tayer is formed on only either main surface of the collector at the positive-electrode and/or the position adjacent to the immerment end, the positive-electrode collector at the cultermost end of the positive-electrode and only the positive-electrode collector at the cultermost end of the positive-electrode and only the positive-electrode collector is formed, the negative-electrode-mix layer is not formed on the negative-electrode collector at the cultermost end of the negative-electrode collector at the cultermost end of the negative-electrode collector positioned at the cultermost end of the negative-electrode collector positioned at the cultermost end of the negative-electrode is, in the direction from the linear position of the collector positioned at the cultermost end of the negative electrode is in the direction from the linear position of the positive-electrode collector. Therefore, the non-reacted active material for the negative electrode in the bettery can be reduced. Thus, the effective battery area can be enlarged normaponalingly. Therefore, the inside portion of the battery can be reduced. Thus, the effective battery area can be enlared and the lifetime against a cycle operation to be alongated.

[0081] The nonequency-electrolyte secondary battery according to the present invention incorporates the negative-electrode lead formed adjacent to the outermost end of the negative-electrode collector accorder positioned at the outermost end of the negative-electrode collector is, in the direction from the inner portion of the collectrode toward the outer portion of the same, positioned more forwards than the outermost end of the positive-electrode collector. Thus, even if the negative-electrode lead plances the apparatur disposed between the coll electrode and fire bettery can, the negative-electrode lead is brought into contact with only the bettery can which is also the negative-electrode. Therefore, internal short circuit can be prevented, any defect can be prevented, and the reliability can be improved.

[1092] The coll electrode of the nonequeous-electrolyte secondary battery according to the present invention is structured such that the distance it. from the outermost end of the negative-electrode collector positioned at the outermost end of the positive-electrode collector positioned at the outermost end of the positive-electrode collector positioned at the outermost end of the positive-electrode collector positioned at the outermost end of the positive-electrode collector positioned at the outermost end of the positive electrode which are positioned fore-end-off in the direction from the inner portion of the coll electrode

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icomand the outer portion of the sterm subtilise  $0 < L \le m0$  on an assumption that the diameter of the soil electrode is d. Thus, internal short circuit can be prevented, the energy density can farthermore be raised and the testime egainst a Cycle operation can furthermore be elongated.

[0083] Although this invention has been described in its preferred form and structure with a certain degree of particularity, it is understood that the present disclosure of the preferred form can be changed in the details of construction and in the combination and arrangement of parts without departing from the scope of the invantion as horoinalise claimed.

#### 10 Claim

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A nonaqueous-electrolyte secondary bettery comprising:

a coll electrode formed by laminating an elongisted positive electrode which has a positive-electrode-mb: layor formed on at least either of main surfaces of a positive-electroda collector and an elengated negative electroda which has a negative-electrodo-mix layer formed on at least either main surfaces of a negative-electrodo collector and by winding a formed leminate such that sold positive electrode is positioned at the outermost position of said coll elactrode, wherein

said positive-electrode-mix layer is formed on only either of main surfaces of said collector at the position adjacent to the outermost and of said politive electrode and/or the position adjacent to the innermost and of said positive electrode, said positive-electrode-mix layer is not formed on said positive-electrode collector at the outsimiset and of said positive electrode and only said positive-electrode collector is formed.

axid negative-electrode-mix layer is not formed on said negative-electrode collector at the outermost end of said negative electrode and only said negative-electrode collector is formed, and

the culturnost and of said negative-electrical collector positional at the outermost and of said negative electrade is, in the direction from the inverportion of said coll electrode toward the outer portion of said coll electrods, positioned more forwards thish the outsimpst and of said positive-electrods collector.

A nonaquisous electrolyte secondary battery according to elebr 1, wherein

eald coll electroide incorporates a negative-electrode lead adjacent to an outerwest end of said negativeelectrode collector positioned at the outlimnost and of said negative electrode, and eald nagative-electroids lead to positioned more forwards than the outermost end of said positive-electrode collector positioned at the outermost and of said positive electrods.

 A nonequence-electrolyte secondary ballary eccording to claim 1, wherein sold coll electrode has a structure that distance i. from the outsimost end of said negative-electrode collector positioned at the outeningst end of said negative electrods to the outermost end of said positive-electrods collector positioned at the outermost end of said positive stactions which are positioned in a fore-end-aft direction from the imer portion of said coil electrode toward the outer portion of said coil electrode satisfies the following relationship on an assumption that the dismeter of the coll electrode to do

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- A nonaqueous-electrolyte secondary battery according to claim 1, wherein said negative electrode mix contains a negative electrode materiol and a binder.
- A nonequecus-electrolyte secondary battery according to claim 4, wherein aski negative-electrode material is at less) one type material estected from a group constiting of a crystalline motel colide and an amorphous metal colds which permit doping/dedoping Rithlem lone.
- 8. A honequeous-electrolyte secondary baltiery according to claim 1, wherein said positive-electrode mix contains a positive-electrode material, a conductive material and a birder.
- A nonequeous-électrolyte secondary battary according to claim 8, wherein asid positive-electrode material is all least one type material anisotad from a group consisting of LBAO $_2$  (where ld to at least any one of Co, NI, Min, Fe, AI, V and TI) and inferience compounds each containing Li.



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- A nonequeous-electrolyte escondary battery sectording to claim 1, wherein
  said separator is made of at least one type material selected from a group consisting of polyethylene and
  polypropylene.
- 4 9. A nonequeous-electrolyte secondary bettery according to claim 1, wherein said positive-electrode collector is made of at least one type material enlected from a group consisting of sturnishum, staintees steel and nickel.
- A nonsquecte-electrolyte accordary battery according to cleim 1, wherein
   ead negative-electrode collector is made of at least one type material extected from a group consisting of copper, stainless steel and nickel.
  - 11. A nonsqueous-electrolyte excandiny bittiery according to claim 1, wherein
    - said nonequeous-electrolyte according betting contains a nonequeous electrolyte propered by dissolving an electrolyte in nonequeous solvent, and said nonequeous solvent to made of at least one type material selected from a group consisting of propylene carbonate, ethylene carbonate, at 2-directrocycthene, 1, 2-directrocycthene, distriptions of electrocycthene, totrolydrofuran, 1,3-dissolvens, distriptions, methylene, sessoninia and proplentifie.
  - A nonequence-electrolyte secondary bintery according to claim 11, wherein
    said electrolyte is at least one type material selected from a group consisting of UCIO<sub>4</sub>, UASF<sub>6</sub>, UFF<sub>6</sub>, UBF<sub>6</sub>,
    UB(C<sub>6</sub>H<sub>6</sub>)<sub>4</sub>, UCI, UBr, USO<sub>3</sub>CH<sub>3</sub> and USO<sub>3</sub>CP<sub>3</sub>

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1. Sekundártiátárie mit nicht-wiksarigem Elektrolyten, umfessend: .

einen Beldrodenwickel erheiten durch Laminteren einer längswistrechten positiven Beldrode, bei der auf zumindest einer der Häupfrächen eines positiven Beldrodenkolisiktors eine Schlicht einer positiven Beldrodennästnung seitgeltegen ist, und einer längsentirechten negativen Beldrode, bei der auf zumindest einer der Haupfrächen eines negativen Beldrodenkolisiktors eine negative Beldrodenmischung seitgefragen ist, wobel das Laminet in der Weise gewickeit ist, dass die positive Beldrode an der Eußeren Seits das Beldrodenwickels Beigt, wobel

die Schicht der positiven Elektrodenmischung nur en einer Stelle, die an dez äußere Ende der pueltiven Elektrode angrenzt und/oder en einer Stelle, die an das innere Ende der positiven Elektrode angrenzt, auf eine der Hauptlifischen des Kolleitore aufgebragen let, und auf dem äußeren Ende der positiven Elektrode die Schicht der positiven Elektroderinnschung nicht auf den positiven Elektroderinnschung nicht auch elektroderinnschung nicht auch elektroderinnschung nicht auch elektroderinnschung nicht auc

am äußeren Ende der negativan Ehiktrade die Schicht aus der nagativen Elektrodenmischung nicht zus den Kollektor der negativen Elektrode sutgetragen int, abo nur der Kollektor der negativen Elektrode verliegt, und wobel in Richtung vom knieren Abschnitt der gewickstein Elektrode gewahen Abschnitt der gewickstein Elektrode gewahen des um äußeren Ende der negativen Elektrode gewahen des um äußeren Eriche der negativen Elektrode gewahen des um äußeren Ende des Rosenten Elektrode gewahen des um aus um äußeren Ende des Bestellens Ende des Kollektors der positiven Elektroge.

- Sekuhdärbettede mit nicht-väsurigem Elektrolyten nech Anspruch 1, wobei
- der Elektrodenwickel einen Anschluss für die negative Elektrode sufweist, der en das äußere Ende das am Sußeren Ende der negativen Elektrode Segenden negeliven Elektrodenkoliekters amschließt, und der Anschluss der negativen Elektrode weiter vorne Begt sie das äußere Ende das am Bulleren Ende der positiven Elektrode liegenden positiven Elektrodenkoliektors.
- 53 3. Sekundärbetterie mit nicht-wisserigem Elektrolyten nach Anspruch 1, wobe! der Elektrodenwickel so gestaltet ist, dass ein Abstand I. zwischen dem äußeren Ende den am äußeren Ende der negativen Elektrode angeordnaten negetiven Elektrodenkollektore und dem äußeren Ende des am äußeren Ende der positiven Elektrodenkollektore, wobei diese in Längerichtung.

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von dem Inneren Abschritt des Elektroderrifickels zum Bußeren Abschritt des Elektroderrifickels hintereinender angeonähet sind, die folgende Beziehung erfülz, unter der Annahma, dass der Durchmasser des Elektroderwickels d enlägefaht:

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- Seinundärtielberie mit nicht wildstrigere Eistriofyten nech Anspruch 1, wobel die negative Eistrodermischung ein Material für die negative Eistrode und ein Bindemittel umfasst.
- Sekundirbatieite mit nicht-witeungem Elektrotyten nech Anspruch 4, wobel
  des Meterial der negativen Elektrode zumlndeist eine Art von Material ist, des ausgewählt ist aus einer Gruppe, welche besteht aus einem kristeitinen Metellosid und einem amorphen Metellosid, welche des Dotteren und
  Dedotteren von Lithlumionen ermöglichen.
- Sekundarbeiteite mit nicht-eräsungem Elektrolyten nach Anspruch 1, wobei die positive Elektrodenmischung ein Material für die positive Elektrode, ein istifähigte Material und ein Bindemitial umfeget.
- Sektirátlárbattaria mit nicht-wäserigem Elektrofyten nach Anapruch 6, wobei
  dag positiva Elektroderanafarial zemindest etne Ant von Material umfacet, das suegowählt ist aus einer Gruppe, welche bits LIMO<sub>2</sub> (wobei M zumindest eines int von Co, Ni, Min, Fe, Al, V und Ti) und Einlegerungsverbindungen beeteht, welche jeweils LI ansheiten.
- Sekuntilirbitterie mit nicht-wüssrigern Elektrohyten nach Anspruch 1, wobei
   der Separator aus zumindest einem der Materialien hergeetelt ist, welche ausgewählt sind aus einer Gruppe, bestehend aus Polyschyten und Polyscopyten.
  - Sekundürbsitisrie mit rücht-vräserigem Elektrolyten nach Anspruch 1, webel
    der positive Elektrodenkollektor aus zumindist einem der Materialien hergestielt ist, die ausgew
    ählt eind aus
    einer Gruppe, beitsihand aus Atumirdein, rosthalein St
    ähl und Nickel.
  - Sekuridärbeitierte mit nicht-wüsszigem Elektrolyten nach Anspruch 1, wobel
    der negetive Elektrodenkollektor aus z\(\text{tribidest}\) einem der Materialien horgestelt ist, die ausgewählt sind
    aus einer Gruppe, bestehend aus Kupfer, roetfreiem Stahl und Nicker.
  - 11. Sekundärbetterle mit nicht-wässrigem Elektrolyten nuch Anspruch 1, wobel
    - diese einen nicht witzerigen Elektrolyten enthält, der hergestellt ist durch Lösen eines Elektrolyten in einem nicht-wäserigen Lösungernittet, und das nicht wäserige Lösungernittet zumindest aus einem der Materistion hergestellt ist, welche euogewählt sind aus einer Gruppe, bestehend eus Propytencerbonet, Ethylenserbonet, 1,2-Dimethoxyathan, 1,2-Diethoxyethan, Diethyloarbonet, y-Butymischun, Tatrahydrofuren, 1,3-Dissolan, 4-Methyl-1,3-dissolan, Diethylicher, Sulfolan, Methylautfolan, Acatonitrit und Propionitrit.
- 40 12. Sekundärtiette mit nicht-wässrigem Elektrolyten nech Anspruch 11, wobet der Elektrolyt zumindest einen der Meterfellen ist, die ausgewählt sind zue einer Gruppe, bestehend aus LICKO<sub>6</sub>, LIAsF<sub>6</sub>, LIPF<sub>6</sub>, LIBF<sub>6</sub>, LIPC<sub>6</sub>H<sub>6</sub>J<sub>6</sub>, LICL, LIBr, LISC<sub>5</sub>CH<sub>6</sub> und LIPO<sub>5</sub>CF<sub>5</sub>.

# 60 Revendications

- 1. Accumulations secondaire à électrolyte non aqueux comprenent :
  - une électrode en bobico formée en stratifiant une électrode positive allongée qui présents une couchs de métange d'électrode positive formée sur su mains l'une des surfaces principates d'un collectaur d'électrode positive et une électrode négative allongée qui présente une couche de métange d'électrode négative formée eur au moine l'une des eurfaces principales d'un collectaur d'électrode négative et un cravulant un stratifié formé de telle sons que ladite électrode positive est disposée aur le position antérieure de ladite électrode positive est disposée aur le position antérieure de ladite électrode positive est disposée aur le position antérieure de ladite électrode positive est disposée aur le position antérieure de ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position antérieure de la ladite électrode positive est disposée aur le position autérieure de la ladite de la ladite de la la la ladite de la ladite de la la la ladite de la la la la ladite de la ladite la ladite de la la la ladite de la la la la la ladite de la ladite de la ladite la ladite la ladite la la la la la la ladite la la ladite la ladite la ladite la ladite la ladite la la ladite la ladite la ladite la ladite la ladite la ladite la la ladite la lad

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bobline, dem lequel

ladita couche de métange d'électrode positive est formée sur uniquement l'une des surfaces principales dudit collecteur à la position adjacente de l'extrémité extérieure de ladite électrode positive et/ou à la position adjacente de l'électronité intérièure de ladite électrode positive, ladite douche de militange d'électrode positive n'est pes formée sur ledit collecteur d'électrode positive à l'autrémité autérieure de ladite électrode positive et saut lestit collecteur d'électrode positive est formé.

seul ledit collecteur d'élactrode positive est formé, ledite couche de métinge d'élactrode négative n'est pas formée sur ledit collecteur d'électrode négative à l'extrémité métineure du ladité électrode négative et seul ledit collecteur d'électrode négative est formé, et l'extrémité métineure dustit collecteur d'électrode négative disposée à l'autrémité autérieure de ladite électrode négative se trouve, dans la direction effent de le partie interné de ladite électrode en bobine vers la partie actains de ladite électrode en bobine, disposée plus en avant que l'extrémité autérieure dudit collecteur d'électrode positive.

2. Acesimulatour excondatra à électrolyte non aqueux selon le revenitionation 1, dens lequel

tedite électivade en babine incorpore un conducteur d'électivade négative edjacent à une extrémité extérieure du dit collecteur d'électrode pégative disposé à l'extrémité extérieure de ladite électrode négative, et ladit conducteur d'électrode négative est disposé plus en évent de l'extrémité extérieure du dit collecteur d'électrode positive disposé à l'extrémité extérieure de ladite électrode positive.

3. Accumulation escondaire à électrolyte non aquieix selon la revendication 1, dans leguel teidite électrode en trobine présente une structure taile que la distance L de l'extrémité extérieure d'util collecteur d'électrode négative disposé à l'extrémité extérieure de ledite électrode négative jusqu'à l'extrémité extérieure de ladite électrode positive qui sont disposé dans une direction longitudinale abant de la partie interne de ladite électrode en bobine vers la partie actame de ladité électrode en bobine extériait la relation suivente en supposent que le dismêtre de l'électrode en bobine activitait la relation suivente en supposent que le dismêtre de l'électrode en bobine activitait la relation suivente en supposent que le dismêtre de l'électrode en bobine activitait la relation suivente en supposent que le dismêtre de l'électrode en bobine activitait la relation suivente en supposent que le dismêtre de l'électrode en bobine activitait la relation suivente en supposent que le dismêtre de l'électrode en bobine activitait la relation suivente en supposent que le dismêtre de l'électrode en bobine extistait la relation suivente en supposent que le dismêtre de l'électrode en bobine extistait la relation suivente en supposent que le dismêtre de l'électrode en bobine extistait la relation suivente en supposent que le dismêtre de l'électrode en bobine extistait la relation suivente en supposent que le dismêtre de l'électrode en bobine extistait la relation suivente en supposent la latin de l'électrode en le la

# 0<1 4 xd

- Accumulateur escondaire à électrolyte non aqueux selon le revendication 1, dans lequel lecti métange d'électrode négative conficet un matériau d'électrode négative et un fiant.
- 35 6. Accumuláteur secondaire à discirolyte non equeux seton la revendiration 4, dans (eque) ledit matériau d'électrode négative est un matériau d'au moine un type choisi parmi un coyde métallique cristallin et un coyde métallique emorphie qui parmet le dopagardédopage d'ions tithium.
  - Accumulatour accondaire à électrolyte non equeux ealen la revendication 1, dans triquel locit métange d'électrone positive confient un matériau d'électrone positive, un matériau conductaux et un fiont.
    - Accumulatour secondaire à électrolyte non equeux selon la revendication 6, dans tequel
      ledit matériau d'électrode positive est un matériau d'au moire un type choisi parmi LIMO<sub>2</sub> (où M est l'un
      quelconque parmi Co, NI, Mn, Fe, Al, V et T) at des composés de couche intermédiaire contenant chaoun LI.
    - Accumulateur secundaire à électrolyte non aqueux selon la revendication 1, dans (eque)
      locit séparateur est constitué d'un matériau d'au moins un type choisi parmi le polyéthytène et le polypropytène.
    - Accumulateur récondaire à électrolyte non aqueux selon la revendication 1, dans lequel ledit doitecteur d'électrode positive aut constitué d'un matérieu d'au moins un type choisi parmi l'aluminam, l'acter incoydable et la picies.
- 40. Accumulation secondaire à électrolyte non aqueux relien le revendication 1, dens lequel ledit collecteur d'électrode négative est constitué d'un matériau d'au moine un type choici parmi le cuivre, l'euler inoxydable et le nictuel.

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11. Accumulation siscondaire à électrolyte non equeux salon le revendication 1, dans lequel

lodit accumulateur secundaire à électrolyte non equeux contient un électrolyte non equeux préparé par dissolution d'un électrolyte dans un solvent non aqueux, et lectit solvent non aqueux est constitué d'un matériau d'au maine un type choiai permi le carbonate de propytène, le carbonate d'étrylène, le 1,2-diméthoxyéthane, le 1,2-diéthoxyéthane, le carbonate de diétryle, la y-butynolactione, le térmhydrofurane, le 1,3-dioxolène, le 4-métryl-1,3-dioxolène, le diétryléther, le suitoisne, le méthylaufolène, l'acétonitrile ef le propionitrile.

 Accumulataur secondaire à électrolyte hon aqueux seton la revandication 11, dans lequal lèdit électrolyte est un matériau σ'eu moins un type choid parmi LICO<sub>4</sub>, LIA<sub>2</sub>F<sub>8</sub>, LIPF<sub>8</sub>, LIBF<sub>4</sub>, LIB(C<sub>6</sub>H<sub>2</sub>)<sub>4</sub>, LICI, LiBr, LISO<sub>2</sub>CH<sub>3</sub> et LISO<sub>2</sub>CF<sub>3</sub>.

Ø 035/039

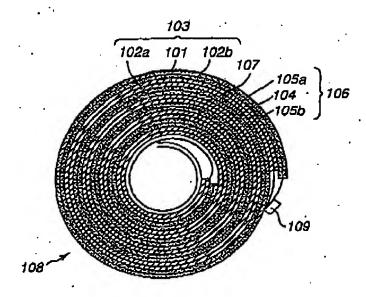


FIG.1

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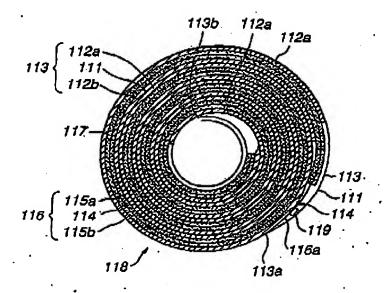


FIG.2

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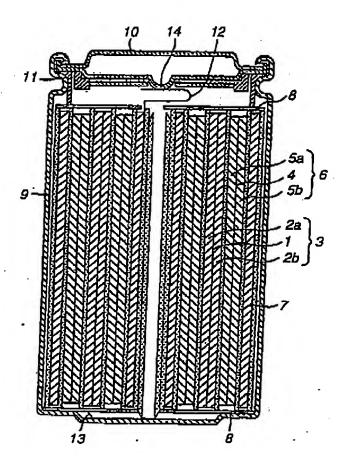


FIG.3

QUALLION LEGAL

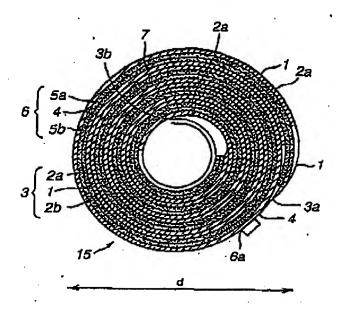


FIG.4

Ø 039/039

QUALLION LEGAL

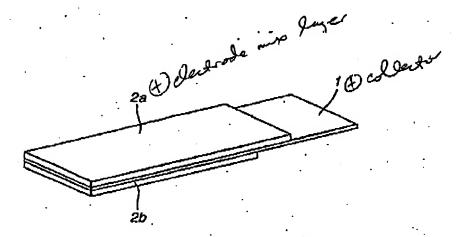


FIG.5